Mixed Carbonate-Clastic-Evaporite Depositional Systems in Rift Basins. Insights from the Suez Rift

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Tectono-stratigraphic models for mixed carbonate-clastic-evaporite systems in extensional settings that integrate fault growth/linkage and facies development are limited to a few recent key publications. In this contribution we review these and existing models using data from the Miocene of the Suez Rift, and Quaternary-Modern systems of the Gulf of Suez - Red Sea. Emphasis is on primary facies/reservoir distribution in relation to structural elements, although secondary reservoir development (karstification, evaporite dissolution/precipitation, dolomitisation) is also addressed. Following discussion of “static” facies models, we address “dynamic” rift/fault propagation impact on stratal architecture/reservoir development.

The Gulf of Suez - Red Sea is a prime area to address models of rift basin mixed carbonate-clastic-evaporite systems as both modern and ancient (Miocene) systems are well exposed, relatively well dated, and young enough to disentangle the sea level/tectonic signature. Furthermore, despite a Mediterranean to Indo-Pacific faunal change, facies associations in Miocene and modern systems are directly comparable.

Quaternary-Modern systems are dominated by fringing reefs, coastal sabkhas, and point-sourced ephemeral clastics. Barrier and isolated carbonate platforms are subordinate, the latter occurring on fault block crests or salt diapirs. Wind- and tide-driven axial currents have a major impact on facies asymmetry; windward margins are reef dominated, leeward margins are sediment tail dominated. Carbonate systems build over clastic spits, both of which enclose coastal lagoons to create sabkhas. Clastic input is also related to wind. Bathymetry, related to rift topography, impacts salinity/faunal diversity.

Outcrop study of Miocene systems implies similar controls on facies development, (with the exception of climate). Stratigraphic development is easier addressed in the rock record however, with HST being reef dominated, and LST-TST being evaporite-rhodolith dominated. However, It should be stressed that evaporate-rhodolith-reef facies transitions are as (more ?) typical of lateral variability within individual half graben due to structural confinement, as opposed to sea-level control.